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Cloud Resolving Ensemble Forecast for the 2008 August Tokyo Metropolitan Area Local Heavy Rainfalls

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On 5 August 2008, scattering local heavy rainfalls occurred various places over the Tokyo metropolitan area, and five drainage workers were claimed by abrupt flooding. The JMA's operational mesoscale model of the day failed to predict occurrence of the local heavy rainfalls, which were given by deep convective cells developed on unstable atmospheric conditions without strong synoptic/orographic forcing.

The GPS total precipitation water vapor (TPW) analysis showed that the initial field of the operational MSM produced by the hydrostatic Meso-4DVAR underestimated water vapor over the Tokyo metropolitan area. To modify the initial condition, a reanalysis data assimilation experiment was conducted with the JMA nonhydrostatic 4DVAR (JNoVA), where GPS TPW data from GEONET were assimilated 2.5 days with 3-hour data assimilation cycles. The JMA nonhydrostatic model with the JNoVA reanalysis successfully reproduced weak to moderate rains over the Tokyo metropolitan area, but small scale convective cells and the associated intense rains exceeding 20 mm /3 hour were hardly predicted with a horizontal resolution of 10 km.

Cloud resolving (2 km) ensemble prediction with 11 members was conducted using the JNoVA reanalysis as the initial condition of the control run. The 2 km ensemble run fairly predicted the areas of scattering local heavy rains and showed a appreciable detection rate in the ROC area skill score. Fractions skill score indicated the value of the cloud resolving ensemble forecast for such the unforced convective rain case.

Keywords: local heavy rainfall, ensemble prediction, cloud resolving model, 4DVAR data assimilation, GPS Total precipitable water